

# New Hampshire Volunteer Lake Assessment Program

## 2003 Interim Report for Chalk Pond Newbury



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# OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **CHALK POND, NEWBURY**, the program coordinators have made the following observations and recommendations:

## FIGURE INTERPRETATION

- **Figure 1 and Table 1:** The graphs in Figure 1 (Appendix A) show the historical and current year chlorophyll-a concentration in the water column. Table 1 (Appendix B) lists the maximum, minimum, and mean concentration for each sampling season that the lake/pond has been monitored through the program.

Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a, and are naturally found in lake ecosystems, the chlorophyll-a concentration measured in the water gives an estimation of the algal concentration or lake productivity. **The mean (average) summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 7.02 mg/m<sup>3</sup>.**

The current year data (the top graph) show that the chlorophyll-a concentration **increased** from June to July. The chlorophyll-a concentration on both sampling events was **less than** the state mean.

The historical data (the bottom graph) show that the 2003 chlorophyll-a mean is **much less than** the state mean.

Overall, visual inspection of the historical data trend line (the bottom graph) shows **a variable, but overall increasing (meaning worsening)** in-lake chlorophyll-a trend since monitoring began in 1986. In the 2004 annual report, we will again conduct a statistical analysis of the historic data to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began.

While algae are naturally present in all lakes/ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes/ponds, phosphorus is the nutrient that algae depend upon for growth. Algal concentrations may increase with an increase in nonpoint sources of phosphorus loading from the watershed, or in-lake sources of phosphorus loading (such as phosphorus releases from the sediments). Therefore, it is extremely important for volunteer monitors to continually educate residents about how activities within the watershed can affect phosphorus loading and lake/pond quality.

- **Figure 2 and Table 3:** The graphs in Figure 2 (Appendix A) show historical and current year data for lake/pond transparency. Table 3 (Appendix B) lists the maximum, minimum and mean transparency data for each sampling season that the lake/pond has been monitored through the program.

Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water. **The mean (average) summer transparency for New Hampshire's lakes and ponds is 3.7 meters.**

The current year data (the top graph) show that the in-lake transparency **decreased** from June to July. The transparency in June was **slightly greater than** the state mean, while the transparency in July was **slightly less than** the state mean.

It is interesting to note that as the chlorophyll concentration increased from June to July, the transparency decreased. We generally expect this inverse relationship in lakes. As the concentration of algal cells in the water column increases, the ability for light to penetrate into the water column decreases.

The historical data (the bottom graph) show that the 2003 mean transparency is **approximately equal to** the state mean.

Overall, visual inspection of the historical data trend line (the bottom graph) shows **a variable, but overall slightly decreasing (meaning worsening),** trend for in-lake transparency since monitoring began in 1986.

However, it is important to point out that the mean annual transparency has actually **increased (meaning improved)** from 2000

to 2003. This increase may be due to the recent diversion of roadway runoff within the watershed. We hope this trend continues.

As discussed previously, in the 2004 annual report, we will conduct a statistical analysis of the historic data to objectively determine if there has been a significant change in the annual mean transparency since monitoring began.

Typically, high intensity rainfall causes erosion of sediments into lakes/ponds and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, lake/pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake/pond. Guides to Best Management Practices designed to reduce, and possibly even eliminate, nonpoint source pollutants, such as sediment loading, are available from DES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 (Appendix A) show the amounts of phosphorus in the epilimnion (the upper layer) and the hypolimnion (the lower layer); the inset graphs show current year data. Table 8 (Appendix B) lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the lake/pond has joined the program.

Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire's freshwater lakes and ponds. Too much phosphorus in a lake/pond can lead to increases in plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 11 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration **decreased slightly** from June to July. The phosphorus concentration on both sampling events was **less than** the state median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration **increased slightly** from June to July. The phosphorus concentration on both sampling event was **less than** the state median.

Overall, visual inspection of the historical data trend line for the epilimnion shows **a relatively stable** phosphorus trend, which means that the concentration has **remained approximately the same** since monitoring began.

Overall, visual inspection of the historical data trend line for the hypolimnion shows **a slightly increasing** phosphorus trend, which means that the concentration has **slightly worsened** since monitoring began.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about its sources and how excessive amounts can adversely impact the ecology and value of lakes and ponds. Phosphorus sources within a lake or pond's watershed typically include septic systems, animal waste, lawn fertilizer, road and construction erosion, and natural wetlands.

#### **TABLE INTERPRETATION**

➤ **Table 2: Phytoplankton**

Table 2 (Appendix B) lists the current and historic phytoplankton species observed in the lake/pond. The dominant phytoplankton species observed this year was ***Dinobryon* (a golden-brown algae)**.

Phytoplankton populations undergo a natural succession during the growing season (Please refer to the "Biological Monitoring Parameters" section of this report for a more detailed explanation regarding seasonal plankton succession). Diatoms and golden-brown algae are typical in New Hampshire's less productive lakes and ponds.

➤ **Table 4: pH**

Table 4 (Appendix B) presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 5.5 severely limits the growth and reproduction of fish. A pH between 6.5 and 7.0 is ideal for fish. The mean pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is **6.5**, which indicates that the surface waters in state are slightly acidic. For a more detailed explanation regarding pH, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean pH at the deep spot this season ranged from **6.22** in the hypolimnion to **6.19** in the epilimnion, which means that the water is **slightly acidic**.

Due to the presence of granite bedrock in the state and the deposition of acid rain, there is not much that can be done to effectively increase lake/pond pH.

➤ **Table 5: Acid Neutralizing Capacity**

Table 5 (Appendix B) presents the current year and historic epilimnetic ANC for each year the lake/pond has been monitored through VLAP.

Buffering capacity or ANC describes the ability of a solution to resist changes in pH by neutralizing the acidic input to the lake. The mean ANC value for New Hampshire's lakes and ponds is **6.7 mg/L**, which indicates that many lakes and ponds in the state are "highly sensitive" to acidic inputs. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The Acid Neutralizing Capacity (ANC) of the epilimnion (the upper layer) continues to remain ***much less than*** the state mean. Specifically, the ANC annual mean this season was **1.20 mg/L**, which is the ***lowest*** annual mean since monitoring began in 1986. This indicates that the pond is ***critically sensitive*** to acidic inputs (such as acid precipitation).

➤ **Table 6: Conductivity**

Table 6 (Appendix B) presents the current and historic conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current. The mean conductivity value for New Hampshire's lakes and ponds is **62.1 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The conductivity has ***increased*** at the deep spot of the lake/pond since monitoring began in 1986. Specifically, the annual mean at the **deep spot** this season was approximately **72 uMhos/cm**. However, the conductivity of the **Inlet** continued to remain relatively ***low*** (the annual mean was approximately **23 uMhos/cm**).

Typically, sources of increased conductivity are due to human activity. These activities include septic systems that fail and leak leachate into the groundwater (and eventually into the tributaries and the lake/pond), agricultural runoff, and road runoff (which contains road salt during the spring snow melt). New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could contribute to increasing conductivity. In addition, natural sources, such as iron deposits in bedrock, can influence conductivity.

We recommend that your monitoring group conduct storm event sampling along the inlet. In addition we recommend that your group conduct a shoreline conductivity survey. This additional sampling may help to pinpoint the sources of increasing conductivity.

*For a detailed explanation on how to conduct storm event sampling, please refer to the 2002 VLAP Annual Report “Special Topic Article”, or contact the VLAP Coordinator. In addition, for instructions on how to conduct a shoreline conductivity survey, contact the VLAP Coordinator.*

➤ **Table 8: Total Phosphorus**

Table 8 (Appendix B) presents the current year and historic total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae’s ability to grow and reproduce. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The total phosphorus concentration was in the **Inlet** this season was relatively low (10 ug/L). This station has had a history of **fluctuating** total phosphorus concentrations. We recommend that your monitoring group conduct a stream survey and storm event sampling along this inlet so that we can determine what may be causing fluctuations.

*For a detailed explanation on how to conduct rain event and stream surveys, please refer to the 2002 VLAP Annual Report “Special Topic Article”, or contact the VLAP Coordinator.*

➤ **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**

Table 9 (Appendix B) shows the dissolved oxygen/temperature profile(s) for the 2003 sampling season. Table 10 (Appendix B) shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling organisms. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The dissolved oxygen concentration was **high** at all depths sampled at the deep spot of the lake/pond. Typically, shallow lakes and ponds that are not deep enough to stratify into more than one or two layers will have relatively high amounts of oxygen at all depths. This is due to continual lake mixing and diffusion of oxygen into the bottom waters induced by wind and wave action.

➤ **Table 11: Turbidity**

Table 11 (Appendix B) lists the current year and historic data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the “Other Monitoring Parameters” section of this report for a more detailed explanation.

The turbidity was relatively low in each of the samples this season. We hope this continues!

➤ **Table 12: Bacteria (*E.coli*)**

Table 12 lists the current year data for bacteria (*E.coli*) testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **MAY** be present. If sewage is present in the water, potentially harmful disease-causing organisms may also be present. Please consult the “Other Monitoring Parameters” section of the report for the current state standards for *E. coli* in surface waters. If residents are concerned about sources of bacteria such as failing septic systems, animal waste, or waterfowl waste, it is best to conduct *E. coli* testing when the water table is high, when beach use is heavy, or after rain events.

The *E.coli* concentration was **low** at the North and South Beach on the July sampling event.

If you are concerned about bacteria levels at these beaches, you may want to repeat this test next season on a weekend during heavy beach use or after a rain event. Since *E.coli* die quickly in cool pond waters, testing is most accurate and most representative of the health risk to bathers when the source (humans, animals, or waterfowl) is present.

## **DATA QUALITY ASSURANCE AND CONTROL**

### **Annual Assessment Audit:**

During the annual visit to your lake/pond, the biologist conducted a “Sampling Procedures Assessment Audit” for your monitoring group. Specifically, the biologist observed the performance of your monitoring group while sampling and filled out an assessment audit sheet to document the ability of the volunteer monitors to follow the proper field sampling procedures (as outlined in the VLAP Monitor’s Field Manual). This assessment is used to identify any aspects of sample collection in



which volunteer monitors are not following the proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure that the samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group did an **excellent** job collecting samples on the annual biologist visit this season! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the biologist to provide additional training. Keep up the good work!

### **Sample Receipt Checklist**

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if the volunteer monitors followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, future re-occurrences of improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did an **excellent** job when collecting samples and submitting them to the laboratory this season! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the laboratory staff to contact your group with questions, and no samples were rejected for analysis.

### **USEFUL RESOURCES**

*Acid Deposition Impacting New Hampshire's Ecosystems*, ARD-32, NHDES Fact Sheet, (603) 271-3505, or [www.des.state.nh.us/factsheets/ard/ard-32.htm](http://www.des.state.nh.us/factsheets/ard/ard-32.htm).

*Aquarium Plants and Animals: Don't leave them stranded*. Informational pamphlet sponsored by NH Fish and Game, Aquaculture Education and Research Center, and NHDES (603) 271-3505.

*Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials*, NHDES-WD 97-8, NHDES Booklet, (603) 271-3503.

*A Boater's Guide to Cleaner Water*, NHDES pamphlet, (603) 271-3503.

*Camp Road Maintenance Manual: A Guide for Landowners*. Kennebec Soil and Water Conservation District, 1992, (207) 287-3901.

*Comprehensive Shoreland Protection Act*, RSA 483-B, WD-SP-5, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/sp/sp-5.htm](http://www.des.state.nh.us/factsheets/sp/sp-5.htm).

## OBSERVATIONS AND RECOMMENDATIONS

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*Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms*, NHDES Fact Sheet, (603) 271-3505, or [www.des.state.nh.us/factsheets/wmb/wmb-10.htm](http://www.des.state.nh.us/factsheets/wmb/wmb-10.htm).

*Erosion Control for Construction in the Protected Shoreland Buffer Zone*, WD-SP-1, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/sp/sp-1.htm](http://www.des.state.nh.us/factsheets/sp/sp-1.htm)

*Impacts of Development Upon Stormwater Runoff*, WD-WQE-7, NHDES Fact Sheet, (603) 271-3503, or [www.des.state.nh.us/factsheets/wqe/wqe-7.htm](http://www.des.state.nh.us/factsheets/wqe/wqe-7.htm)

*Iron Bacteria in Surface Water*, WD-BB-18, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-18.htm](http://www.des.state.nh.us/factsheets/bb/bb-18.htm)

*Is it Safe to Eat the Fish We Catch? Mercury and Other Pollutants in Fish*, NH Department of Health and Human Services pamphlet, 1-800-852-3345, ext. 4664.

*Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes*, WD-BB-9, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-9.htm](http://www.des.state.nh.us/factsheets/bb/bb-9.htm).

*Management of Canada Geese in Suburban Areas: A Guide to the Basics*, Draft Report, NJ Department of Environmental Protection Division of Watershed Management, March 2001, [www.state.nj.us/dep/watershedmgt/DOCS/BMP\\_DOCS/Goosedraft.pdf](http://www.state.nj.us/dep/watershedmgt/DOCS/BMP_DOCS/Goosedraft.pdf).

*Proper Lawn Care In the Protected Shoreland, The Comprehensive Shoreland Protection Act*, WD-SP-2, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/sp/sp-2.htm](http://www.des.state.nh.us/factsheets/sp/sp-2.htm).

*Road Salt and Water Quality*, WD-WMB-4, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/wmb/wmb-4.htm](http://www.des.state.nh.us/factsheets/wmb/wmb-4.htm).

*Sand Dumping - Beach Construction*, WD-BB-15, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-15.htm](http://www.des.state.nh.us/factsheets/bb/bb-15.htm).

*Swimmers Itch*, WD-BB-2, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-2.htm](http://www.des.state.nh.us/factsheets/bb/bb-2.htm).

*Through the Looking Glass: A Field Guide to Aquatic Plants*. North American Lake Management Society, 1988, (608) 233-2836 or [www.nalms.org](http://www.nalms.org).

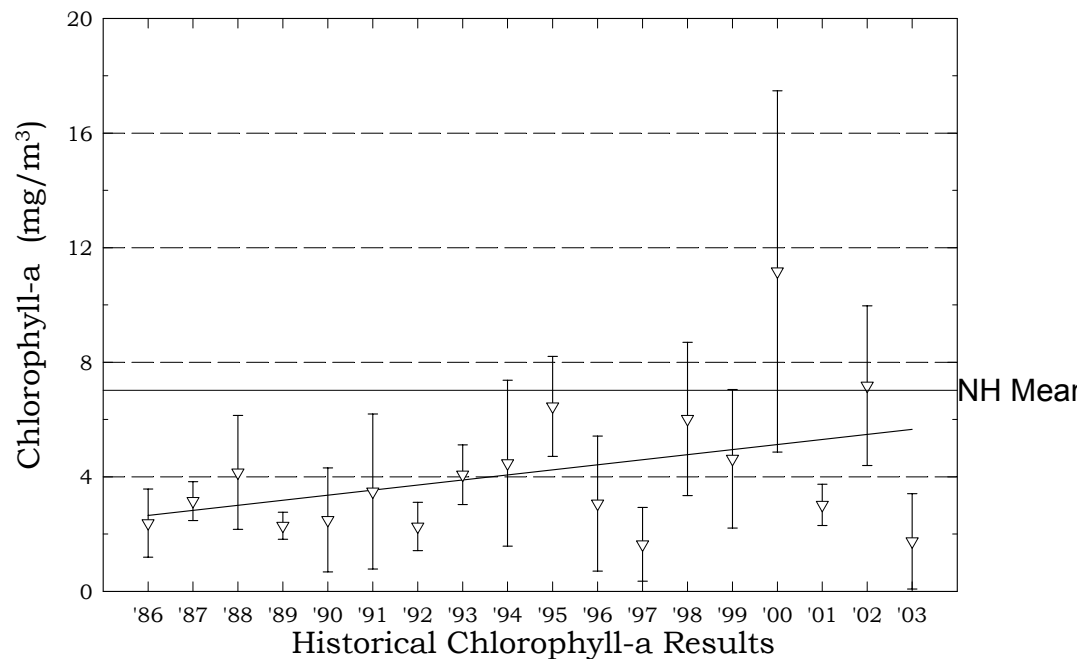
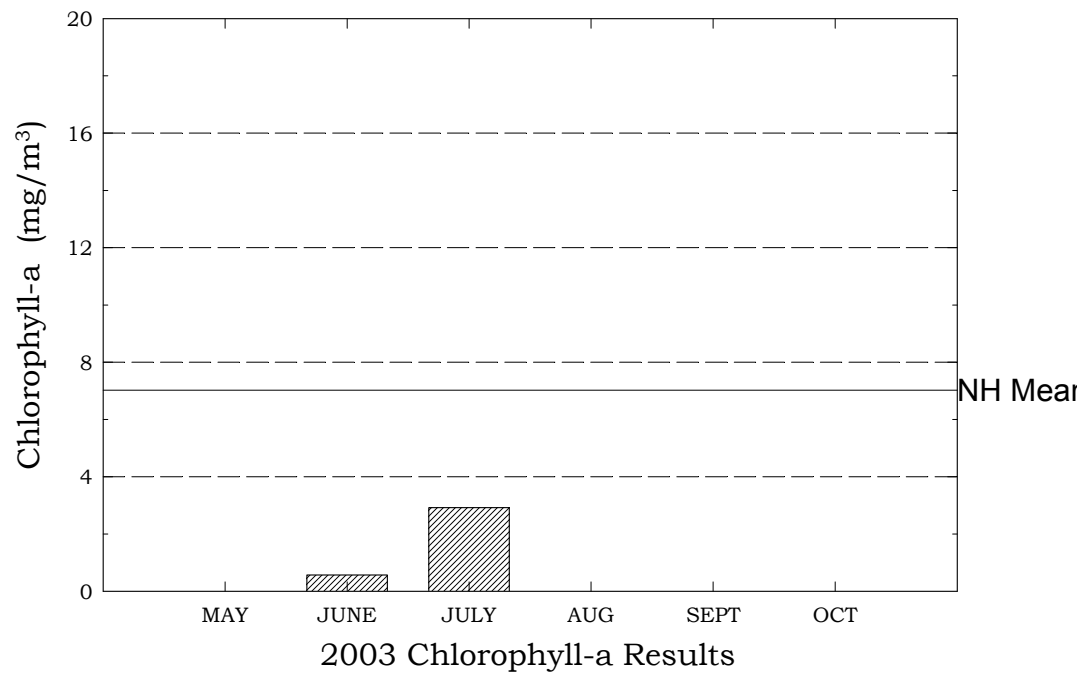
*Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants*, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-4.htm](http://www.des.state.nh.us/factsheets/bb/bb-4.htm).

# APPENDIX A

## GRAPHS

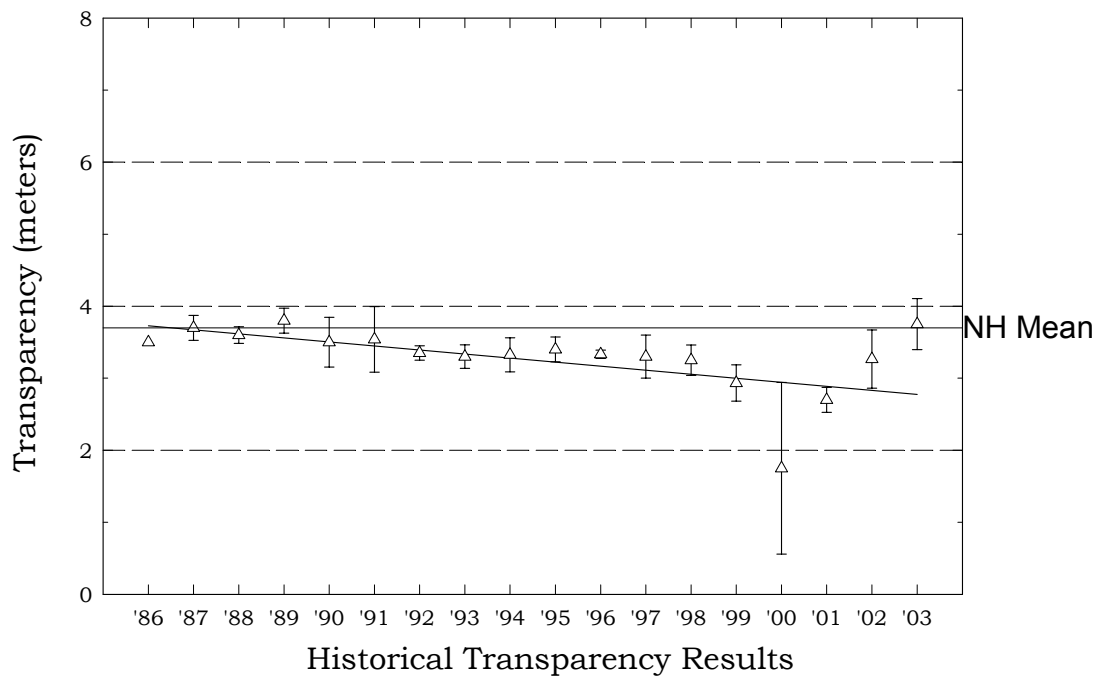
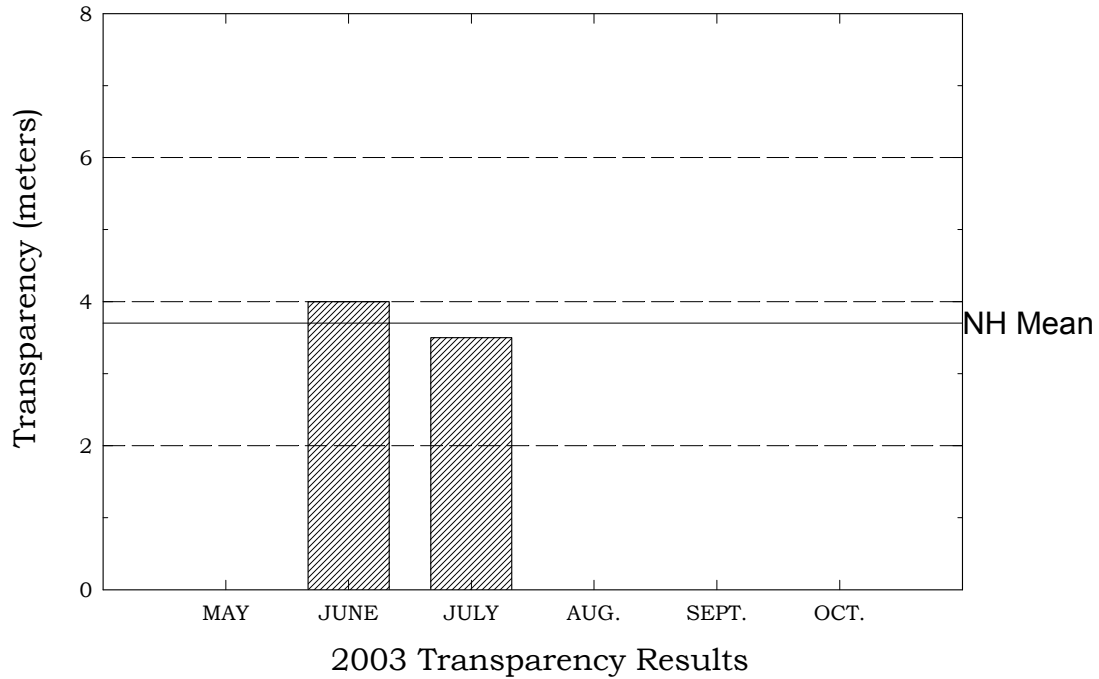
## Chalk Pond, Newbury

**Figure 1.** Monthly and Historical Chlorophyll-a Results



## Chalk Pond, Newbury

**Figure 2.** Monthly and Historical Transparency Results



## Chalk Pond, Newbury

**Figure 3.** Monthly and Historical Total Phosphorus Data.

